ECOLOGICAL LAND SURVEY AND THE CANADA LAND DATA SYSTEM

Proceedings of a Workshop, January 10th, 1979

Edited by D.M. Welch

Ecological Land Classification and Evaluation Division
Lands Directorate Environment Canada
Ottawa, K1A OE7

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PREFACE

Many past and present ecological land surveys have been reported through the Canada Committee on Ecological Land Classification (CCELC) and many more are conducted by some of the nearly 2000 persons on the CCELC mailing list. One of the needs expressed by this group is for guidelines on data handling and related systems. The discussions in this workshop are offered as technical comments to aid in map production, scribing, data coding and the like for computer entry and use. Although they relate specifically to the Lands Directorate's own geographic information system, the Canada Land Data System, we feel that some general usefulness will be gained through distribution of these proceedings. For further information on the points contained, contact either the appropriate participant directly or the CCELC Secretariat, Tel (819) 997-2320.

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Workshop on Ecological Land Data and the Canada Land Data System

January 10th, 1979

Present: E. Wiken, D. Welch (Convener and Reporter), J. Thie,
K. Taylor, D. Taylor, W. Switzer, A. Savoie, P. Rump,
C. Rubec, T. Pierce, V. Neimanis, G. McLean,
N. Lopoukhine, G. Ironside, H. Hirvonen, C. Gordon,
M. Comeau, N. Chartrand and E. Beaudette.

OPENING REMARKS: D. WELCH

In the course of the last few months there have been several ecological land survey maps entered into the Canada Land Data System (CLDS). These maps are of several actual or proposed National Parks (Gros Morne, Terra Nova and the N. Yukon) and a map sheet of the Manitoba Northern Resources Information Program. In addition, there are current efforts for CLDS to handle Northern Land Use Information Series maps. These activities gave rise to several informal discussions and conclusions regarding the most efficient and useable manner of recording land data vis-à-vis manual interpretation, computer entry and the interpretation of computer output of ecological and other land data.

This workshop is held in order to collect and record these experiences for the benefit of future users. Participating are members of the Ecological Land Classification and Evaluation Division, ELCE (Wiken, Welch, Thie, D. Taylor, Rubec, Pierce and Ironside), the Canada Land Data System Division (Switzer, Gordon, Comeau, Chartrand and Beaudette), the Land Use Monitoring Division (K. Taylor, Rump, McLean), POlicy Research and Coordination Branch (Neimanis), Lands Directorate Atlantic Region (Lopoukhine, Hirvonen), and Parks Canada (Savoie).

The specific objectives of this workshop are to discuss the technical aspects of data storage, input, handling and output. The findings will likely be incorporated into Guidelines for Ecological Land Survey to be written by ELCE. More immediately, some recommendations from this workshop may be included in contract specifications for a proposed ecological land survey of part of Labrador, or for future surveys conducted for other agencies which consult the Lands Directorate.

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The workshop was organized into several sections:

- Opening Remarks	Welch
- Ecological Land Survey	Wiken
- ELS and Related CLDS Inputs:	
Manitoba pilot map sheet	Thie
Northern Yukon	Wiken
Parks Canada, ELS Projects	Savoie
Northern Land Use Information Series	K. Taylor
Policy Analysis Division	V. Neimanis
Remote Sensing and Land Use	C. Rubec
- Needs for ELS data specifications:	
Can. Comm. Ecol. Land Classif. Proposed Guidelines	J. Thie
Labrador ELS Proposal	Lopoukhine
- CLDS Experiences and Recommendations:	
Introduction	Switzer
Cartographic Problems Encountered	Beaudette
Data Coding " "	Comeau
Data Handling " "	Chartrand
Data Output " "	Gordon
Overview and Discussion	Switzer
- Closing Remarks	Welch

ECOLOGICAL LAND SURVEY: E. Wiken

An overview of ecological land survey was given, using a background paper distributed to participants. The topics discussed were:

- What is ecological land survey?
- What practical value does it have?
- What type of data is involved?
- What constitutes an ecosystem?
- Surveys so far.

MANITOBA PILOT MAP SHEET: J. Thie

The Canada Land Inventory consists of several independent assessments of land capability - for agriculture, ungulates, etc. When overlaid during land resource analysis, a profusion of small polygons result. To circumvent this, it is now recommended that natural resources be surveyed using the ELS method. This produces a single set of land units, and a set of data for each unit.

ELS therefore produces simple units with complex symbols. This symbology is, however, difficult to analyze for a user, and difficult to display cartographically. As a step toward resolving this difficulty, the CLDS was adopted to store and analyze ecological data for an area of about 1800 km^2 mapped by the Manitoba Northern Resources Information Program. A paper describing this experiment was circulated to participants.

NORTHERN YUKON ELS: E. Wiken

This ELS, conducted by Lands for Parks Canada, cover 35,000 km^2 of the N. Yukon. Maps at 1:1,000,000 (Ecoregions), 1:500,000 (Ecodistricts) and, over half of the study area, 1:250,000 (ecosections) were produced. With the intent of being computer-compatible, each region, district and section was given a discrete identifying number, even though several such ecosystems may have been similar. Thus:

3	Ecoregion 3, Old Crow Basin Ecoregion
3.04	Driftwood River Ecodistrict, within Region 3
3.05-21	Ecosection 21 within Ecodistrict 3.04

At both the district and section levels, a variety of characteristics were recorded, each with a set of numbered classes. Initially it was hoped that each characteristic would have no more than 10 classes, numbered 0-9, with 0 representing a non-occurrence, and 9 a non-applicable characteristic, such as shoreline type on dry-land units. In practice, however, many characteristics had less than 10 classes, and some, especially vegetation, had more.

In retrospect, CLDS advised that there is no need to limit class numbers to one digit; the system can handle up to 8 alphanumeric characters, so that initials or abbreviations of actual names may be used, thus helping interpretation of CLDS output.

PARKS CANADA ELS PROJECTS: A. Savoie

(i) Gros Morne National Park

This area was mapped into about 6000 units, each with 23 variables. Several problems arose, one being that individual polygons were not given unique identifiers, so that information cannot easily be retrieved unit by unit. This must be done manually from the map. Also, several errors, such as gaps in legend numbering, became evident during entry into CLDS; thus computerization provides for a useful verification.

Lakes and rivers, etc. were not numbered. This made location difficult since the land polygons were not numbered either, and reference to shorelines, etc. would have been useful.

The legends on the map included several graphic symbols, and were also inconsistent in the arrangement of digits, eg. 1,2 ... 9,10,11, ...100 being confused by the computer where "1" should have been written "001" and instead was read as "100".

(ii) Terra Nova National Park

Problems here were mainly those of complexity. Map polygons were well numbered, but with 40-60 characters per ecotype, up to 100 ecotypes per ecosystems, and with additional data on ecodistricts, shorelines, etc., there are up to 600 variables per unit.

(iii) Northern Yukon Ecological Land Survey

The map and data are well-suited to computerization. On the other hand, the total use of numbers makes the survey very difficult to use without computers: a better balance is needed. Numbers do not have unique meaning, and so memorisation is hard. Eg. the materials and vegetation may both have a value of, say, 4, it would be easier if the data read as, say, HT or BS (ie. Hummocky Till, Black Spruce).

(iv) Overall

Ecological Land Surveys of parks and proposed parks is useful for making master plans. In this context, the computer retrieval of data greatly facilitates the application of ELS. This is possible because both planners and computer systems tend to be centralized.

ELS is also useful for on-the-spot management purposes. The park manager will always need hard copy data, often the actual maps. Unique identifiers for land polygons are useful for this. With a simple teletype terminal, a manager could locate units on his hard copy map, and make data retrieval and manipulations for one polygon or more on his terminal: plotters would not be necessary.

NORTHERN LAND USE INFORMATION SERIES: K. Taylor

With about 200 NLUIS maps now available, there is a need for a computerized retrieval system for the information. Although local users will always need hard copy maps, it was felt that the CLDS Automap could help with compilation and drafting, and with transfer of digital data direct to CGIS. To test these possibilities, the Yellowknife sheet is being input. One problem that has already arisen is that not all map sheets have the same legend; large area comparisons could therefore be difficult.

POLICY ANALYSIS DIVISION: V. Neimanis

This division makes use of CLDS rather than inputs to it. Policy Analysis Division activities relate to

a) analysis of CLI data in general - where certain types of land are found (land resources around urban areas, etc), and
b) relations to other data sets, such as relating land resources to flood risk maps and to coal development areas.

A summary paper was presented to participants.

REMOTE SENSING AND LAND USE: C. Rubec

Testing of several Remote Sensing methods is underway to evaluate their potential for a) ecosystem mapping in settled areas,
b) up-dating of Canada Land Inventory land use data
c) mapping of land cover, and
d) use as a data collection method for the Canada Land Use Monitoring Program.

So far tests have included CLDS retrievals of CLI data, and CLDS analysis of overlays of CLI and Landsat imagery.

CANADA COMMITTEE ON ECOLOGICAL LAND CLASSIFICATION: J. Thie

The CCELC is a national committee representing provincial, federal, private and university interest in ecological land survey. The committee has recommended that the ELCE Division prepare a new set of Guidelines for Ecological Land Survey. At the same time, ELCE have completed draft guidelines for ELS for the Federal Environmental Assessment and Review Process. Our experience in this has shown that guidelines for ELS must include suggestions as to computer storage and retrieval. To the end, the findings of this workshop will be instrumental.

PROPOSAL FOR ECOLOGICAL LAND SURVEY IN LABRADOR: N. Lopoukhine

Lands Directorate is currently preparing contract specifications for an ecological land survey in Labrador. To avoid problems in handling the data, such as computer incompatibility, it is hoped to specify map and legend format with entry to a computer system in mind; hence this workshop should provide useful guidance.

CANADA LAND DATA SYSTEM: EXPERIENCES AND RECOMMENDATIONS: W. Switzer

In addition to maps discussed so far, CLDS is also inputting one for the Hudson Bay Lowlands. The following speakers were introduced: all are members of the CLDS Division.

PROBLEMS OF ELS MAP PRODUCTION AND INPUT TO CLDS: E. Beaudette

(i) Manitoba Pilot sheet

- thematic boundary lines were too thick for easy following by a .008 scribe point.

- classification was too long and confusing for the draftsmen to transcribe off the map.
- actual map base was too large to fit the scanner; it had to be split.
- polygon boundaries were often confused with map base lines.

(ii) Gros Morne

- the map was too large; it had to be split up.
- the legend was confusing; there was a confusion over the sequence of symbols and the inclusion of graphic symbols.

(iii) Terra Nova

- there were no geographic Co-ordinates on the map manuscript; shoreline had to be used for orientation and location. Without a geographic grid, compilation errors are more likely.
- the map was again too large; the scanner cannot handle sheets larger than 116 cms x 116 cms.

(iv) Northern Yukon

- the ecosection map had to be split.

(v) NLUIS - Yellowknife Sheet

- a very complex map and legend, especially once transferred to a single-colour format.
- compilation of future maps could be difficult because of changes in legends/symbols.
- in future, the project personnel could compile on Automap and produce printed maps directly.

(vi) CMHC Infrastructure

- original map submitted as an enlarged colour print mounted on 1/2 inch plywood; it hav been re-photographed and colour negative used for transfer of image on white scribe material by photo-mechanical processing.

CODING OF ELS DATA: M. Comeau

- coding time and cost increases with the length and complexity of the legend.
- similarly, don't use narrative in computer systems.
- use a coding scheme that is both computer compatible and understandable by the user. The codes could be alphanumeric abbreviations for each class of a variable, thus aiding user memorization. Conversely, all variables should be coded all the time; gaps are unrecognized by computers (Editor's Comment - suggest adding "no-occurence" and "non-applicable" classes to some variables).

- notwithstanding the above, avoid English (or French)-like words or sentences, as this increases the chance of spelling errors which a computer can't recognize.
- set up editing rules to help checking - eg. fix the total number of characters per polygon; use a definite sequence of letters and numbers.
- don't use an all-numeric code; this is difficult for the user.
- where numbers are to be used, maintain a constant number of digits, thus, if values go from zero to one hundred, seventy-eight must be written as 078, eight as 008, etc. Ie. right-justify
- don't cross zeroes, but write the letter "O" as Ø on the map. In a table the zeroes need not be written.

HANDLING OF ELS DATA: N. Chartrand

(i) Problems

- in some cases polygon descriptions are unbalanced, as when some polygons are single (one variable) and others are complex (2-3 variables).
- variable classification lengths create problems for drafting and computer personnel.
- programmers and draftmen had to interpret gaps of varying lengths, thereby increasing errors and loss of data.
- conversion of map symbols to alphanumeric characters increases the potential for error.
- errors can occur when different codes are combined into one, as when $BU.T_4$ actually means BU2 BT2.

(ii) Advantages

- CLDS can track down many errors, such as polygons with no data, adjacent polygons with identical descriptions, invalid or incorrect codes, unmatched polygons across map borders, open polygons, etc.
- descriptions of polygons are easy to change, update or extend.
- single themes or computer interpretations can easily be retrieved.
- computer handling can easily provide diversity indexes.

OUTPUT OF ELS DATA: C. Gordon

In response to ELS inputs, the CLDS graphics retrieval system was modified to handle more variables; a maximum of 50 variables if the "Gerber" plotter is required, otherwise no limit. with minor modifications this upper limit may be increased.

A monochromatic Cathode Ray Tube terminal is the interactive medium through which a user obtains reports and plots, and generates full scale plots on the Gerber plotter. The line plots from the Gerber plotter may be used to create colour maps via photo-mechanical methods. In 1980 the interactive graphics system will operate on a colour terminal with a grey scale hard copy unit.

OVERVIEW OF CLDS RECOMMENDATIONS: W. Switzer

(i) There is much diversity between ecological land surveys in terms of scale, paper sizes, legends, symbology, etc. There should be more standardization.

(ii) Most problems are conceptual rather than technical. They relate mainly to a need for a lengthy learning process by draftsmen, coding personnel, users, etc.

(iii) Every map unit should have a unique identifying number.

(iv) Data, legends and tables should follow the format of key punch forms: blank spaces and right and left justification should be carefully considered. However, letter symbols/abbreviations can be used to aid readability.

(v) On any individual map sheet, CLDS can handle up to 116 cm x 116 cm size, and up to 6,000 individual map units. On ELS maps this is unlikely to be a problem. This limit can be circumbented by splitting sheets.

(vi) Preferably use regular NTS grids, scales and sheet sizes as base maps.

(vii) ELS teams should liaise with their computer team as soon as possible to help with formats for map and to devise legends.

CLOSING REMARKS: D. Welch

Participants were thanked. The notes from this workshop will be circulated, and used ultimately as a basis of ELS guidelines on data handling.

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